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THE REDISCOVERY OF *ABRONIA ALPINA*, A RARE SPECIALIZED ENDEMIC OF SANDY MEADOWS IN THE SOUTHERN SIERRA NEVADA, CALIFORNIA

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INTRODUCTION

The genus *Abronia* of the Nyctaginaceae is represented by 35 species restricted to light or sandy soils of temperate western North America. The ten California species range from the coastal strand into interior valleys and deserts to montane regions. The best known and most often recognized species are *A. villosa* S. Wats. from desert dunes and roadsides, *A. maritima* Nutt. ex Wats., and *A. umbellata* Lam. from coastal dunes and sandy bluffs. The coastal species have been well documented by Tillett (1967). The inconspicuous montane species are often difficult to find and generally go unnoticed. Three species occur exclusively at high elevations in California: *A. nana* Wats. ssp. *Covillei* (Heimerl.) Munz grows at ca. 7000 ft in the San Bernardino Mountains and up to 9400 ft in the Inyo Mountains; *A. turbinata* Torr. has been collected at Mt. Pinos but is mainly scattered along the east slope of the Sierra Nevada and west to Mono Lake ranging between 4000 and 8000 ft; and *A. alpina* Bdg. occurs between 8000 and 9000 ft in the sandy meadows of the southern Sierra Nevada. T. S. Brandegee (1899) described *A. alpina* from *Purpus 1877*, type, as being located in Monatchy Meadows of Mt. Whitney. Various names have been applied to the meadow where the type was collected on the basis of the *Purpus 1877* collection. In all cases the name should be Monache Meadows. *Abronia alpina* was described as being not uncommon in the area. Jepson (1914) cites collections from Ramshaw and Templeton Meadows where it formed a lavender-pink fringe on the white sandy borders of the meadows. Apparently the past distribution of this plant was wider than it is today, but *A. alpina* is definitely rare now.

Dr. P. A. Munz traveled through the sandy meadows from Monache Meadows to Cottonwood Lakes during two separate trips, 1949 and 1950. He collected excellent plant material from the meadows and sandy slopes, but never found *A. alpina*. Even then *A. alpina* had become rare in the area. In September, 1968, I went to Templeton and Strawberry Meadows, but returned after an exhaustive search without *A. alpina*. In 1969 I received information from Mrs. Mary DeDecker leading directly to the "rediscovery" and collection of *A. alpina* in Ramshaw Meadows.

Abronia alpina presents special adaptations and structural modifications worth noting in contrast to other species of the genus.


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AREA, GEOLOGY AND CLIMATE

Ramshaw Meadows are located in the Inyo National Forest, Tulare Co., north of the Toowa Range at 8800 feet. Templeton Meadows (8700 ft) and Monache Meadows (7900 ft) are southeast and south of Ramshaw Meadows. These meadows are formed along the South Fork of the Kern River as it flows southeast and then turns south toward Lake Isabella.

The ridges surrounding the meadows were formed from Jurassic acid intrusives (granitic rocks). Both Templeton Mtn. and Monache Mtn. are volcanic in origin from the Pleistocene. Alluvium deposits occur in both Templeton Meadows and Monache Meadows, and farther north in the meadows around Cottonwood Lakes where they are accompanied by glacial deposits (State of Calif. Dept. of Nat. Res. 1938). Along the edges of the meadows are soft, steep slopes deposited from the ever crumbling granitic ridges above. These slopes are not stabilized but are constantly shifting by erosion to the lower levels of the meadows. The slopes are porous, dry, relatively hot, and often devoid of any vegetation. The soils within the meadows are rich in organic materials while the soils of the slopes are obviously lacking in organic materials.

Freezing temperatures in midsummer and subzero (ca. −28°) readings in winter are not uncommon at these elevations. Thunderstorms are frequent in the summer with a single storm producing several inches of rain in a matter of hours. Both diurnal and seasonal changes in temperature are extreme. The seasonal snowfall may vary from 23 percent to 215 percent of the "normal" from year to year (U.S.D.A., 1949). The spring growing season may be shortened one year by cold and the next by drought. Late afternoon breezes are common but high winds are not a prominent feature of the environment.

Cattle are present in all three meadows and especially numerous in Templeton and Monache Meadows. The effect that they have on the native plants of the dry slopes is hard to assess.

HABIT AND ECOLOGY

All evidence indicates that *A. alpina* is as restricted to soil type as are many other species of *Abronia*. It is distributed along the dry, open, granitic slopes of the meadows below Lodgepole Pine Forest and above the Sagebrush Scrub. The Sagebrush Scrub forms a band of vegetation on the drier sites just above the wet meadows (Fig. 1).

Standley (1918) refers to *A. alpina* as an annual, but it is definitely a mat forming perennial with the characteristic reductions which often accompany plants in alpine habitats. The mat formed does not always represent only one plant but more often is composed of three or four individuals

Fig. 1–4.—Fig. 1. Ramshaw Meadows, site of *Abronia alpina*, edge of a sandy slope formed by the erosion of granitic intrusives from above, Lodgepole Pine Forest (left background). (Photograph by George R. Wilson).—Fig. 2. Mat habit of *A. alpina* with *Mimulus coccineus*. × 1.3.—Fig. 3. A single plant showing a head of flowers and orbicular leaves with long petioles (10–20 mm), *Wilson 1285*. × 2.—Fig. 4. Underside of a single plant showing perennial stem and anthocarp turned downward due to the recurving of the peduncle, *Wilson 1285*. × 3.5.

(Fig. 2). Solitary plants were observed growing in the area. The larger branches are prostrate with the smaller branches and leaves growing erect. Seedlings grew directly beneath the older (parent ?) plants in clusters of four and five, possibly growing from the seed of a single inflorescence. These clusters may form a mat reaching 8 to 10 inches across. The plants are rather delicate as compared to other alpine mat forming plants. The leaves are reduced (blade length 4–9 mm and petiole length 10–20 mm) as compared to the other species of the genus which have an average blade length of 1–5 cm and petiole of 1–4.5 cm.

The flowers of *A. alpina* produce an attractive delicate lavender-pink to white bouquet with the sweet fragrance typical of the genus. The number of flowers per inflorescence is reduced to four or five. Flower size (perianth length 10–15 mm, limb 6–9 mm) is close to the average for the genus. Note the relative size of the leaves as compared to the flowers as shown in Fig. 3. The anthers and stigma are not exserted from the perianth tube. It is the base of the perianth tube that forms the "fruit" in *Abronia* which is called an anthocarp. The peduncle first grows upward pointing the buds and opening flowers upward, and then recurves downward plunging the maturing anthocarp beneath the plant (Fig. 4). The anthocarp, illustrated by Standley (1909), is only 4–5 mm long. It is easy to see how these tiny indehiscent anthocarps may be buried as a cluster. This leaves them in a position under the dwarf plant where they can not be readily removed by animals, wind, or water. They subsequently tend to germinate close to their site of origin. By contrast *Hulsea vestita* Gray, an associate plant, has villous achenes with broad, lacerate pappus-paleae, and numerous achenes exposed on a subscapose head. Evidence of its dispersibility is its wide range and presence in all of the meadows observed.

Only a few species grew with *A. alpina*. The species collected with *A. alpina* (*Wilson 1285-1296*) were *Lupinus Breweri* Gray (*Wilson 1297*), *Mimulus coccineus* Congd. (*Wilson 1298*), *Eriogonum spergulinum* Gray var. *pratense* (S. Stokes) J. T. Howell (*Wilson 1299*), and *Hulsea vestita* (*Wilson 1300*). These species were common inhabitants of the granitic slopes throughout Ramshaw Meadows, Tunnel Meadows and Templeton Meadows. Although associate plants were abundant in adjacent areas which appeared to be similar, identical in many cases, to that where *A. alpina* was collected, *A. alpina* was not present.

Why is *A. alpina* now restricted in area and number in the face of ample soil, climatic and general ecological opportunities? It is possible to visualize that the constant pressure of materials being moved into the meadows, where *A. alpina* can not become established, would emphasize modifications allowing the anthocarp to remain on favorable sites. *Abronia alpina* must have evolved into the area from plants with good dispersibility, being either selected against or not supported by the pressures for reduction as the species adapted to the harsh conditions of this alpine environment. The majority of *Abronia* species has winged anthocarps, but not *A. alpina*. Its small rounded anthocarp is devoid of wings, contains a seed that fills the entire body cavity, and is neatly tucked under the older plant. This mechanism may work to hold the anthocarp on favorable ecological sites. It may

also be restrictive to the extent that the anthocarp can not get to other favorable sites. The general lack of wind as a dispersal agent, and the fact that the peduncle tends to bend downward in a majority of *Abronia* species leads to the conclusion that *A. alpina* followed a line of evolution toward losing rather than developing dispersibility. This tiny *Abronia* is now clinging to the edge of a narrow area, barely holding its own, apparently unable either to evolve toward new dispersal mechanisms or to adapt to new soil types.

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